U.S. Geological Survey (USGS) Maryland-Delaware-District of Columbia
Monthly Water Conditions Summary

February 2015 Highlights: Record February low streamflow to the Chesapeake Bay. Record low groundwater level at USGS observation well in Carroll County, Maryland. Second coldest February on record in Baltimore, Maryland.

Why is it important for the USGS to collect and analyze water-resources data?

USGS water data are valuable to the public, researchers, water managers, planners, and agricultural users, especially during floods and droughts. These data can be used to assess how water resources respond to changes in climate. Scientists at the USGS have measured streamflow and groundwater levels to assess water resources for over 125 years.

In addition to providing the most extensive set of historical streamflow and groundwater data available to the public, the USGS continues to collect water data and quality-assures the data using standardized techniques across the country. The uniformity of the dataset enables multi-state comparisons and other comparative statistical analyses that better inform policy makers of the possible water-resources conditions they might encounter in the future.

The sites used in this water summary were carefully selected to show the response of streamflow and groundwater levels to weather conditions. Ideally, these sites will show no effects from human influences. The streamflow and groundwater data are ranked in comparison to the historical record and summarized. Precipitation and reservoir data are also presented to give a more complete picture of the region's water resources.

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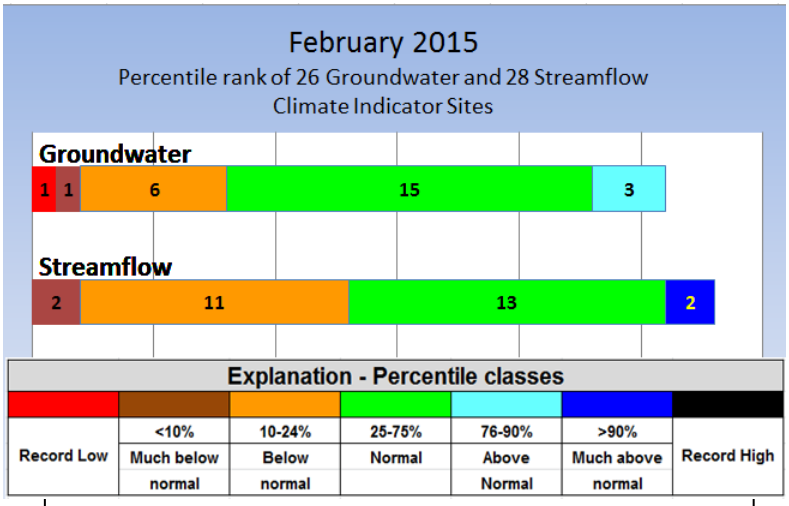
February 2015 air temperatures were the second coldest since record-keeping began in 1934 at the National Weather Service (NWS) station in Baltimore, Maryland, and were 10.5 degrees below normal for the month. Precipitation was also below normal in February, although above normal snowfall occurred. The cold weather caused many streams to freeze, requiring estimates to be made for the monthly means, and these values are provisional and subject to change.



A **percentile** is a value on a scale from 0 to 100 that indicates the percent of a distribution that is equal to or below it. A percentile between 25 and 75 is considered normal.

For example, a groundwater level in the 90th percentile is equal to or greater than 90 percent of the values recorded for that month.

In February, 58 percent of groundwater levels and 46 percent of monthly mean streamflows were normal (between the 25th and 75th percentiles) at sites used to monitor the response of water resources to changes in climatic conditions in Maryland, Delaware, and the District of Columbia.

Groundwater levels were normal in 58 percent (a 15-percent decrease since January), or 15 of 26 of the wells used to monitor climatic conditions in Maryland and Delaware in February. The groundwater level in the USGS observation well in Carroll County, Maryland was at a February record low and the USGS observation well in Allegany County, Maryland had a groundwater level below the 10th percentile. Of the remaining wells, six had below normal groundwater levels and three had above normal groundwater levels.

February monthly mean streamflows were normal at 46 percent (a 31-percent decrease since January), or 13 of the 28 streamgages. There were insufficient data to calculate monthly means at five sites in February.

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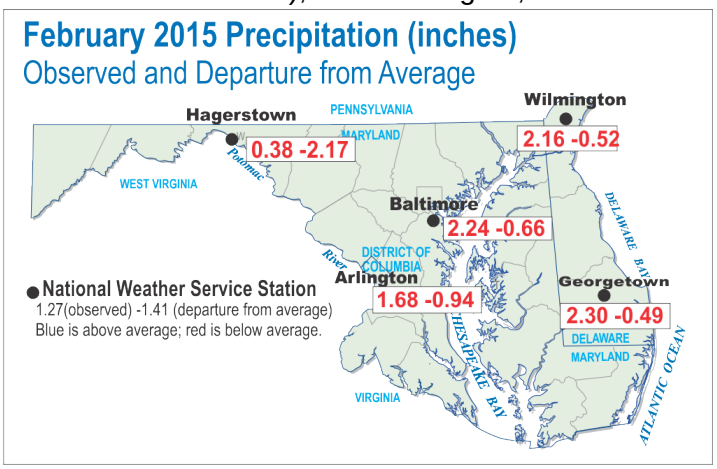
Streamflow was above normal at 2 streamgages, and below normal at 13 streamgages, although ice may be influencing the rank of many streams in the region.

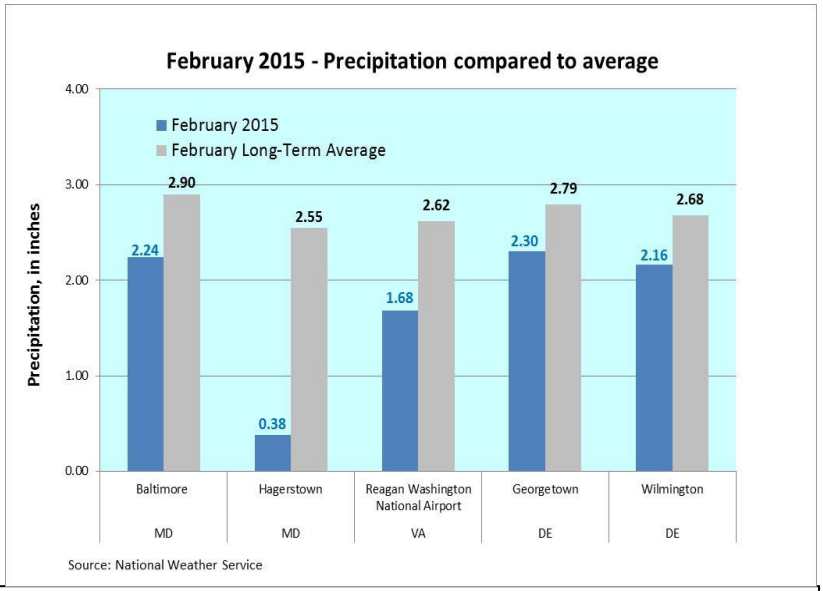
February 2015 Precipitation and Weather

Precipitation in February was below the long-term average at the five NWS Mid-Atlantic weather stations. The highest amount of monthly precipitation was in Georgetown, Delaware with 2.30 inches and the lowest was in Hagerstown, Maryland with 0.38 inches. Much of the precipitation in February was in the form of snowfall. Baltimore had 14.6 inches of snow, which is 6.6 inches above normal, Arlington, Virginia had 9.8 inches (4.1 inches above normal), and Wilmington, Delaware had 10.6 inches (2.3 inches above normal).



National Weather Service Stations

Baltimore =
Baltimore/Washington International Thurgood Marshall Airport (BWI)
Georgetown =
Georgetown, Sussex County Airport
Hagerstown =
Hagerstown Regional Airport
Arlington =
Ronald Reagan Washington National Airport
Wilmington =
New Castle Airport



The NWS Middle Atlantic River Forecast Center's (MARFC) 365-day precipitation data for Maryland, Delaware, and the District of Columbia ranged from below to above average, with 15 of the 23 counties in Maryland and all 3 counties in Delaware in the normal range. In Maryland, Montgomery County had the highest surplus of precipitation with 8.0 inches, and Allegany County had the largest deficit of 8.7 inches over the 365-day period from February 2014 to February 2015. See the links below to view the NWS MARFC data.

Sources: National Weather Service and Middle Atlantic River Forecast Center (MARFC)
MD and DC: http://www.weather.gov/climate/index.php?wfo=lwx
DE: http://www.weather.gov/climate/index.php?wfo=phi:
MARFC http://www.erh.noaa.gov/marfc/Precipitation/Departures/

February air temperatures were below the long-term average at all five NWS Mid-Atlantic weather stations ranging from 8.7 - 10.8 degrees Fahrenheit below average. The average temperatures ranged from 24.4 degrees Fahrenheit in Hagerstown, Maryland to 30.3 degrees Fahrenheit in Arlington, Virginia near the District of Columbia.

In Baltimore, it was the second coldest February on record (since 1934) and record low temperature records were set for 8 days. According to the Baltimore Sun web site *"Only three times has a month been colder here: in February 1934, when temperatures averaged 24.3 degrees at the U.S. Customs House downtown; in January 1918, with an average of 24.1 degrees at the Customs House; and in January 1977, which averaged 22.9 degrees at Baltimore-Washington International Thurgood Marshall Airport."*

http://www.baltimoresun.com/news/weather/weather-blog/bal-wx-last-month-was-baltimores-secondcoldest-february-on-record-20150302-story.html

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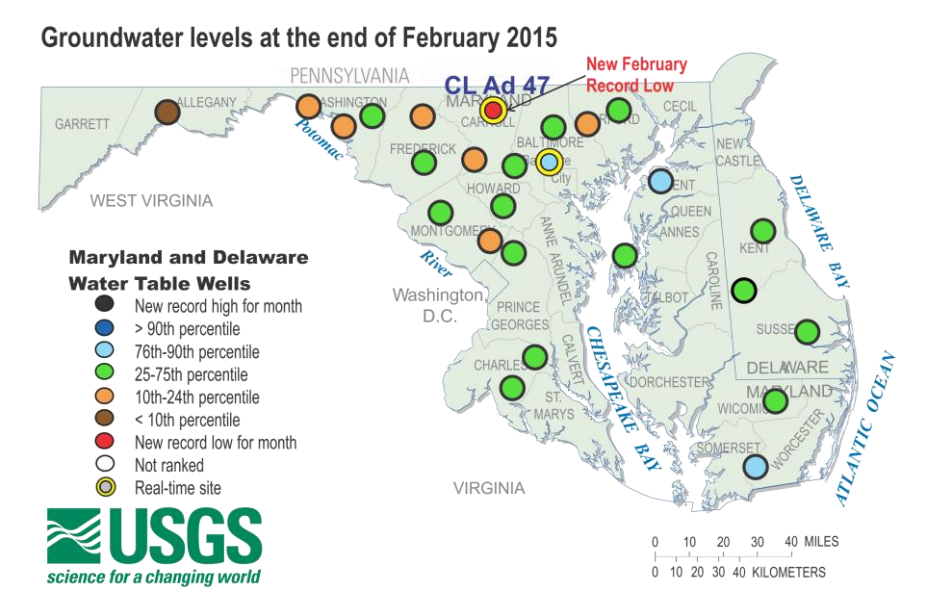
Groundwater

The USGS monitors groundwater levels in unconfined aquifers, providing observations that can be compared to both short-term and long-term changes in climatic conditions. Twenty-six groundwater wells were selected based on the following criteria:

- Located in an unconfined (water-table) aquifer;
- Open to a single, known hydrogeologic unit/aquifer;
- Groundwater hydrograph reflects changes in climatic conditions;
- No indicated nearby pumpage and likely to remain uninfluenced by pumpage, regulated streamflow, or changes related to human activities;
- Minimum period of record is 10 years of continuous/monthly records;
- Minimally affected by irrigation, canals, drains, pipelines, and other potential sources of artificial recharge;
- Well has a casing – dug wells are generally not used;
- Water levels show no apparent hydrologic connection to nearby streams;
- Well has never gone dry; and
- Long-term accessibility likely.

February 2015 Groundwater Levels

Groundwater levels ranged from a record low in Carroll County, Maryland (see below) to above normal in three counties. Groundwater was normal (between the 25th and 75th percentiles) in February in 58 percent, or 15 of the 26 wells used to monitor climatic conditions in Maryland and Delaware. This was a drop of 15 percent since January. In three observation wells, groundwater levels were above normal, including those in Baltimore, Kent, and Somerset Counties in Maryland.



Groundwater levels in Delaware were normal in February in the three USGS observation wells.

To access the clickable groundwater map, go to:
http://md.water.usgs.gov/groundwater/web_wells/current/water_table/counties/

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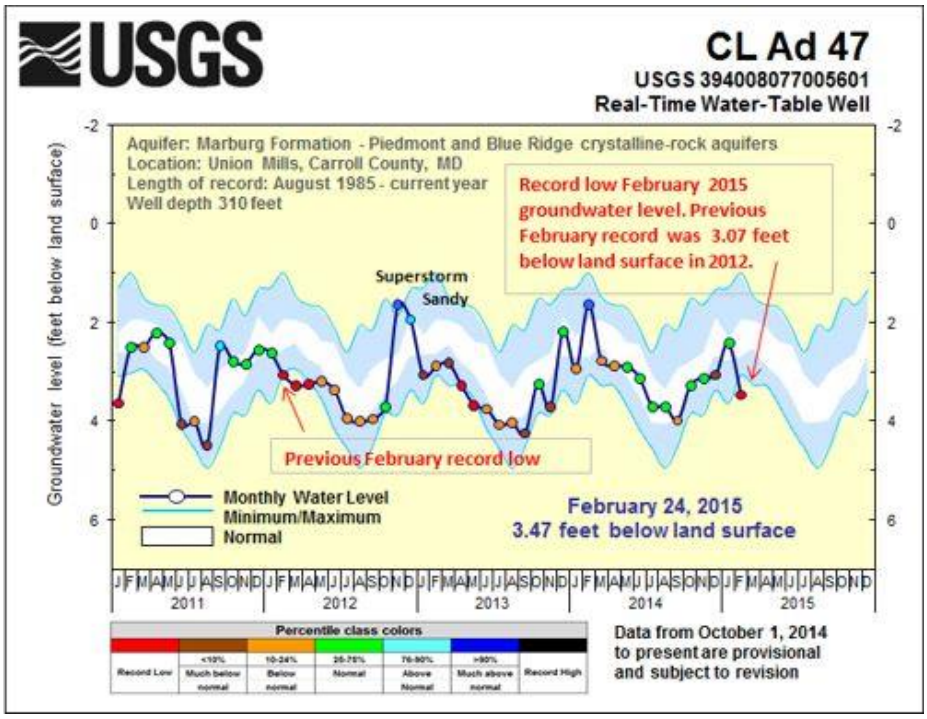
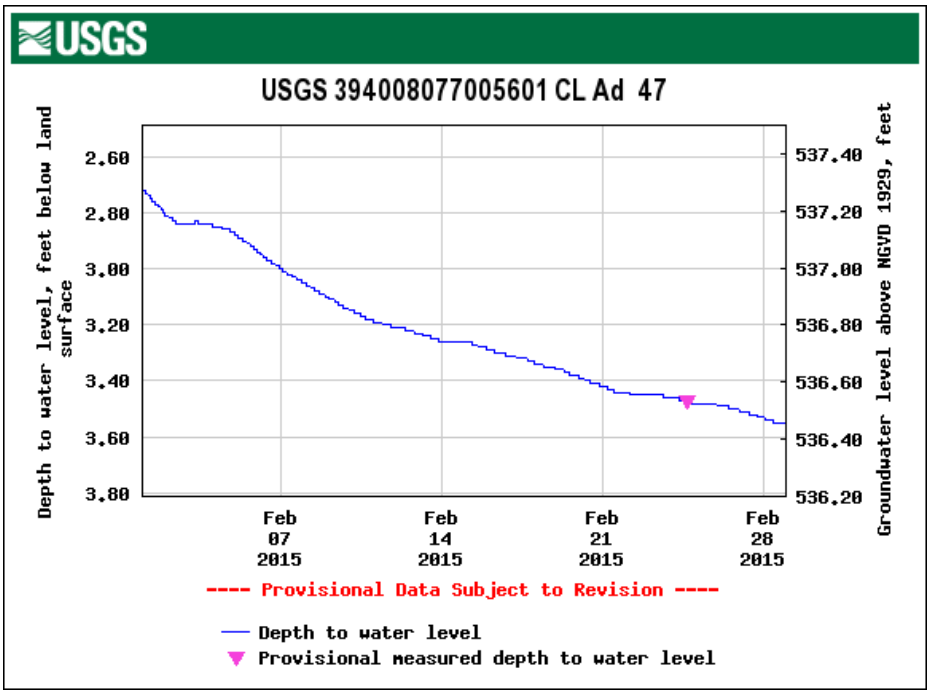
In Carroll County, Maryland, the groundwater level in USGS observation well CL Ad 47 dropped 1.05 feet, going from normal in January to a record February low at 3.47 feet below land surface. The previous February record low was in 2012 (highlighted on hydrograph). In 2002, the February groundwater level was the third lowest at 2.98 feet below land surface. Record-keeping began in 1985 at this observation well.



Five-year groundwater hydrographs can be viewed at:
http://md.water.usgs.gov/groundwater/web_wells/current/water_table/counties

These 5-year hydrographs show groundwater levels as a dark blue line, the minimum and maximum monthly values, and the normal range (between the 25th and 75th percentiles) as a white band based on the period of record. The maximum water level is at the top of the upper blue section and the minimum water level is at the bottom of the lower blue section in the graph. Each monthly measurement is colored according to the percentile rank in which it falls for the month.

The real-time groundwater level for observation well CL Ad 47 shows a downward trend during February. Based on the historical data, the groundwater level does not typically get this low until the middle of summer. The discrete measurement confirms proper functioning of the equipment used to collect real-time data.



Link to real-time data for CL Ad 47:
http://waterdata.usgs.gov/md/nwis/uv?cb_72019=on&format=gif_default&site_no=394008077005601&period=&begin_date=2015-02-01&end_date=2015-02-28

Streamflow

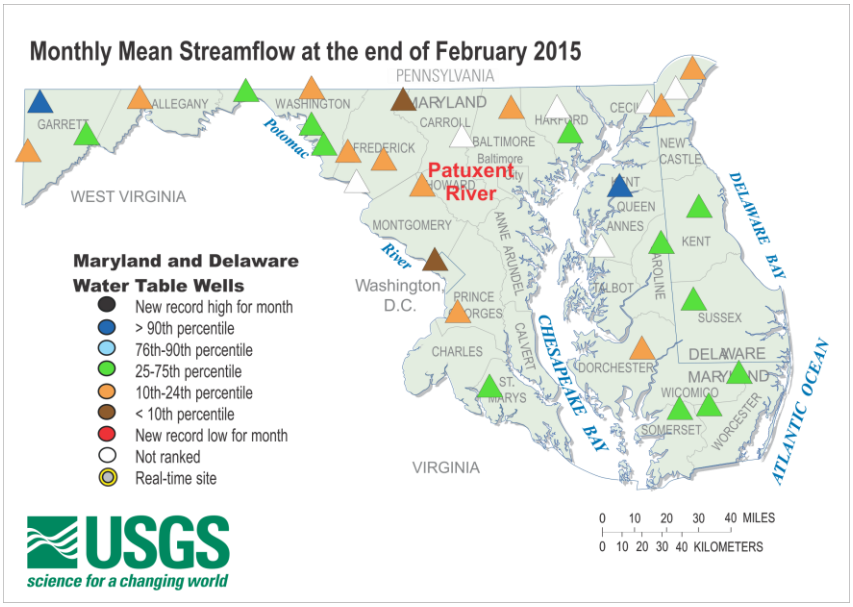
Streamflow data are used for many purposes. A few of the most common uses are to assess water supply and the risk of droughts and floods. Streamflow data are also used to calculate loads of chemical constituents and assess how biological communities are affected by hydrologic conditions. The USGS operates the most extensive network of streamgages in the region.

The streamflow locations chosen for the monthly water summary were selected based on the following criteria:

- Minimum period of record is 10 years of continuous data;
- Watershed areas greater than 5 square miles;
- Streamflow is not regulated, or has relatively natural flow;
- Streamflow data reflect climatic conditions; and
- The surrounding area and watershed are not urban.

February 2015 Streamflow

Monthly mean streamflows were normal in February at 13 of the 28 USGS streamgages used to monitor climatic response in Maryland, Delaware, and the District of Columbia. Normal is considered to be between the 25th and 75th percentiles. As in January, there were periods of extremely cold temperatures in February, which could cause streamflow values to be higher or lower than the provisional values due to cold temperatures and ice formation in the stream channels. There were five sites where a monthly mean discharge could not be determined because of ice effects.



To access the clickable streamflow map, go to:
http://md.water.usgs.gov/surfacewater/streamflow/

Streamflow was above the 90th percentile in February at Bear Creek in Garrett County and Morgan Creek in Kent County, Maryland. February 2015 is the first month since August 2014 when less than 70 percent of the monthly mean streamflows have been in the normal range.

In Delaware, monthly mean streamflow was below normal in February at two streams in northern Delaware and normal in two streams in central and southern Delaware.

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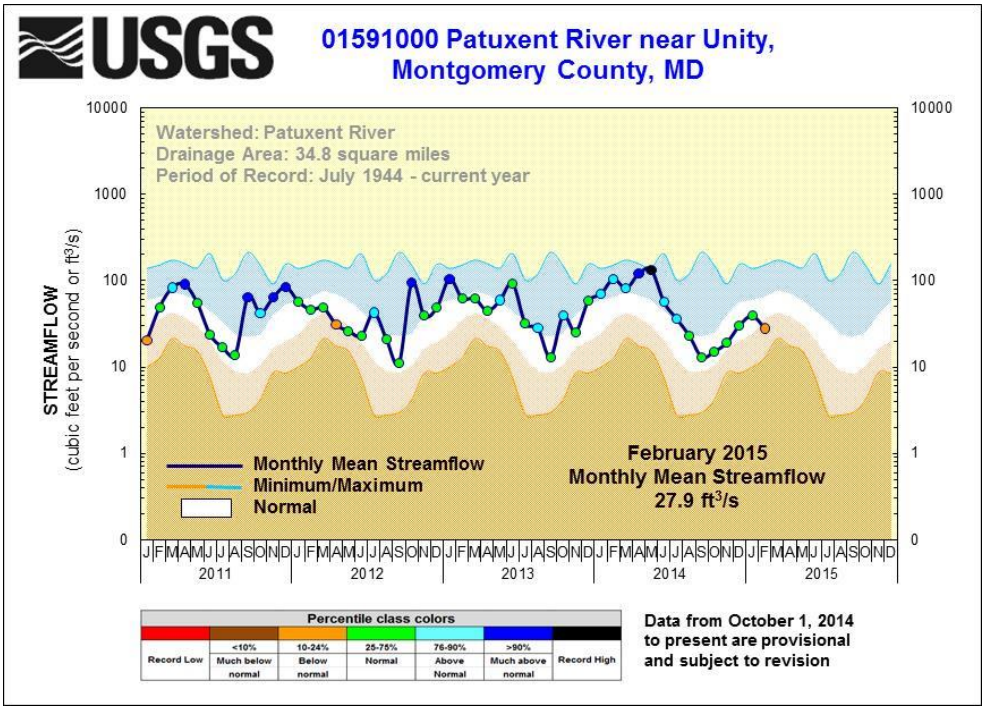
The monthly mean streamflow on the Patuxent River near Unity in Montgomery County, Maryland was below normal in February 2015 at 27.9 cubic feet per second. Streamflow had been normal (between the 25th – 75th percentiles) during the preceding 6 months. The monthly mean streamflow typically climbs at this time of year with the average peak in May on the Patuxent River, however, as in many streams discussed in this report in February, the streamflow decreased. This could be due to the cold temperatures and ice in the streams.

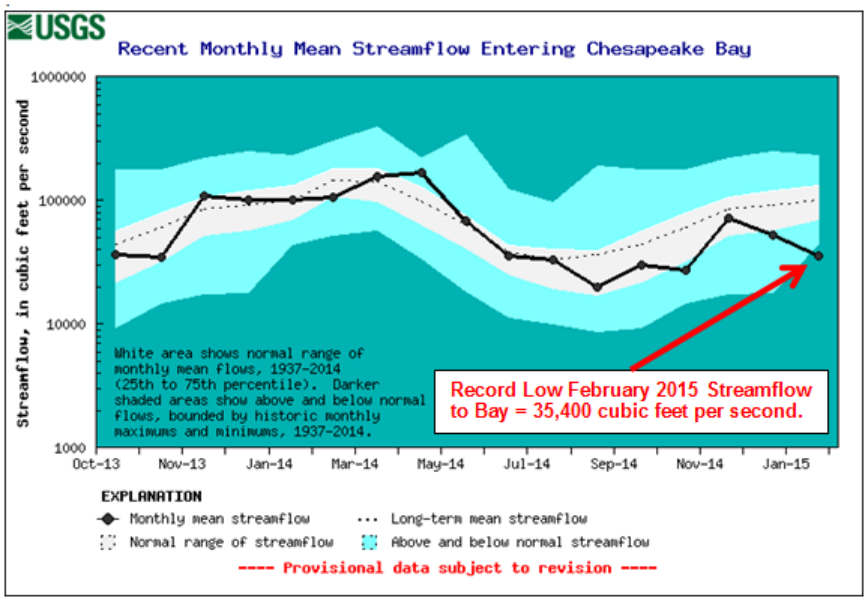


Five-year hydrographs can be viewed at:
http://md.water.usgs.gov/surfacewater/streamflow/

The dark line in the 5-year hydrograph represents the monthly mean streamflow for this period and the white band shows the normal range (25th to 75th percentiles) based on the period of record. The maximum monthly mean streamflow is at the top of the blue shaded section, and the lowest monthly mean streamflow is at the top of the dark orange area. Each monthly mean measurement is colored according to the percentile rank in which it falls for the month.

Estimated Streamflow to the Chesapeake Bay

The USGS estimates monthly mean freshwater streamflow to the Chesapeake Bay using streamflow measurements from the Susquehanna, Potomac, and James Rivers. In February 2015, the monthly mean freshwater flow to the Chesapeake Bay was 35,400 cubic feet per second (ft^3/s; provisional, and subject to revision), which is the lowest February* value since record-keeping began in 1937. This value is 8,000 ft^3/s less than the next lowest value in 1963, which was 43,400 ft^3/s. The value in February 2002 at the start of the drought that year was 55,600 ft^3/s.



Runoff in the Chesapeake Bay watershed carries pollutants, such as nutrients and sediment, to rivers and streams that drain to the Bay. The amount of water flowing into the Chesapeake Bay from its tributaries has a direct impact on how much pollution is in the estuary. Generally, as river flow increases, it brings more nutrient and sediment pollution to the Bay.

Runoff from winter and spring rains delivers pollution loads that affect the summer water-quality conditions in the Bay. The river flow also affects the salinity levels conditions that are important for fish, crabs, and oysters. USGS Chesapeake Bay Coordinator and hydrologist, Scott Phillips, states: "*The February low freshwater streamflow to the Chesapeake Bay will not have a large impact on the Bay at this time, but if the low-flow pattern continues into spring, fewer pollutants may enter the Bay and improve water-quality conditions over the summer."*

Ten Lowest February Freshwater Monthly Mean Streamflows to the Chesapeake Bay

Values are in cubic feet per second (ft^3/s). February mean streamflow is 102,000 ft^3/s based on 78 years of record.

	Year	Total
1	2015	35,400
2	1963	43,400
3	1980	44,400
4	2007	48,800
5	1941	49,400
6	1944	52,800
7	1989	53,900
8	1992	55,000
9	1977	55,300
10	2002	55,600

The average (mean) monthly streamflow to the Chesapeake Bay for February is 102,000 ft^3/s. The normal range for average (mean) monthly streamflow for February is between 69,400 ft^3/s and 132,000 ft^3/s, the 25th and 75th percentiles of all February values. These provisional statistics are based on a 78-year period of record.

In February 2015, the Susquehanna River, which contributes the largest amount of freshwater streamflow to the Chesapeake Bay of the three rivers, was at 10,800 ft^3/s for the monthly mean streamflow, which is the lowest February streamflow on record. The previous record was 11,900 ft^3/s in 1980.

The February 2015 Potomac River flow to the Chesapeake Bay was the 6th lowest on record and the 7th lowest on the James River. An interesting note is that the lowest value for both of these rivers was in 2002 and on the James River, 6 of the lowest 10 values have been since 2001.

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Reservoir Levels

Available reservoir storage at the end of February 2015 in the Baltimore reservoirs (Loch Raven, Liberty, and Prettyboy) was 99.41 percent of available storage capacity, or a total of 75.40 billion gallons of water. Baltimore City Environmental Services Division manages the Baltimore reservoirs.

Total normal storage in the Triadelphia and Duckett Reservoirs, which serve parts of Howard, Montgomery, and Prince George's Counties in suburban Maryland around the District of Columbia, was 95.12 percent of normal storage capacity at the end of February 2015, with 10.10 billion gallons of water. Not all of the water in the Patuxent Reservoirs is usable; for operational purposes, percent of normal storage capacity is used, but this value can exceed 100 percent of the usable storage. The Washington Suburban Sanitary Commission (WSSC) manages the Patuxent reservoirs.

February 2015	Percent available/normal storage	Volume (billion gallons)
Baltimore Reservoirs **Baltimore City – Environmental Services Division**		
Liberty	98.91%	36.40
Loch Raven	100.00%	21.20
Prettyboy	99.72%	17.80
Total	99.41%	75.40
Patuxent Reservoirs **Washington Suburban Sanitary Commission (WSSC)**		
Triadelphia	96.05%	5.38
Duckett	94.19%	4.72
Total	95.12%	10.10